ST7110-30A Series

User Manual

Version 1.1

December 2014

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Revision History

No.	Author	Version	Date	Changes
1	Beth	1.0	11/26/2014	First release
2	Beth	1.1	12/30/2015	Add item 7 in safety instructions in Chapter 3.
3				

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1. Preface

Wiwynn ST7110-30A is a unique and high-capacity storage system with high availability and flexibility

1.1 Introduction

Wiwynn ST7110-30A supports up to 30 SAS hard drives in a 2U chassis. This high-density storage system is designed with redundant controllers to provide full redundant data path to each HDD.

1.2 About this Manual

The contents in this manual include:

Chapter 2 – describes the system specification, front and rear components, and the different boards

Chapter 3 – shows how to replace the system and system components

Chapter 4 – lists the Wiwynn supported SES pages

Chapter 5 – lists the checkpoints and errors

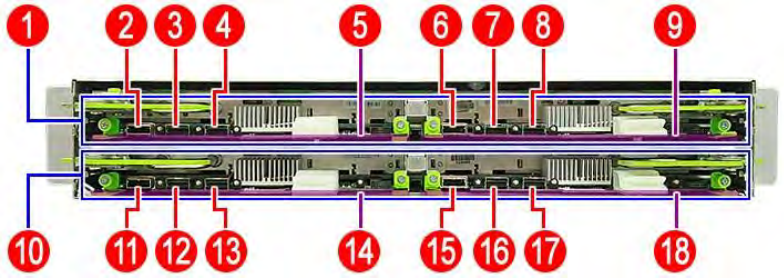
2. System Tour

2.1 System Specification

Storage and IO	
Expander	SAS6G Expander
Storage	Thirty 3.5" hot-plug drive bays (fifteen per tray): • SAS/SATA SSD with 2.5" drive cage • SAS HDD (10K rpm) • Nearline SAS HDD (7.2K rpm) • SATA HDD (7.2K rpm) Two INT mini-SAS 6G (SASx4) ports One EXT mini-SAS 6G (SASx4) port
Remote Management	SES, SMP
Power Supply, Physical and Packaging Specifications	
Power Supply	Centralized 12V DC bus bar
Power Consumption	300W (Idle); 400W (Max)
Form Factor	2 OU rack
Dimensions	93.5 (H) * 536 (W) * 795 (D) (mm)
Weight	38 kg ~ 55 kg

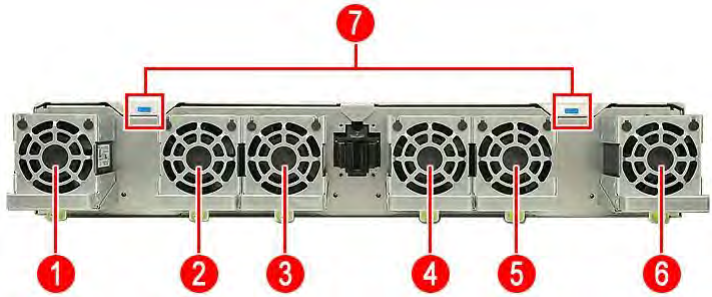
2.2 Front Panel

The illustration below shows the system front panel.



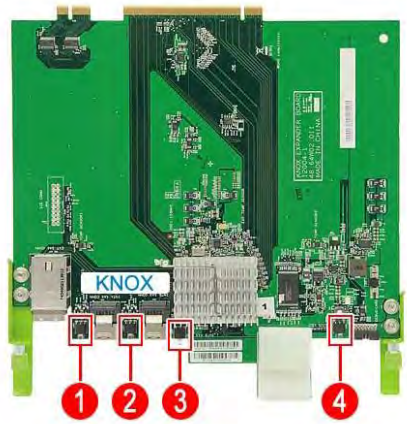
Item	Component	Item	Component
1	HDD Tray 1	10	HDD Tray 2
2	External Mini SAS Connector	11	External Mini SAS Connector
3	Internal Mini SAS Connectors	12	Internal Mini SAS Connectors
4		13	
5	SAS Expander Board Upper Tray Primary Side	14	SAS Expander Board Lower Tray Primary Side
6	External Mini SAS Connector	15	External Mini SAS Connector
7	Internal Mini SAS Connectors	16	Internal Mini SAS Connectors
8		17	
9	SAS Expander Board Upper Tray Secondary Side	18	SAS Expander Board Lower Tray Secondary

2.3 Rear Panel



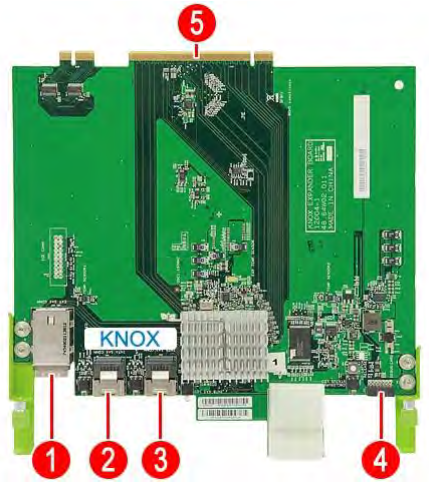
Item	Component
1	Fan 1
2	Fan 2
3	Fan 3
4	Fan 4
5	Fan 5
6	Fan 6
7	Top Cover Thumbscrews

2.4 SAS Expander Board LED Indicator Status



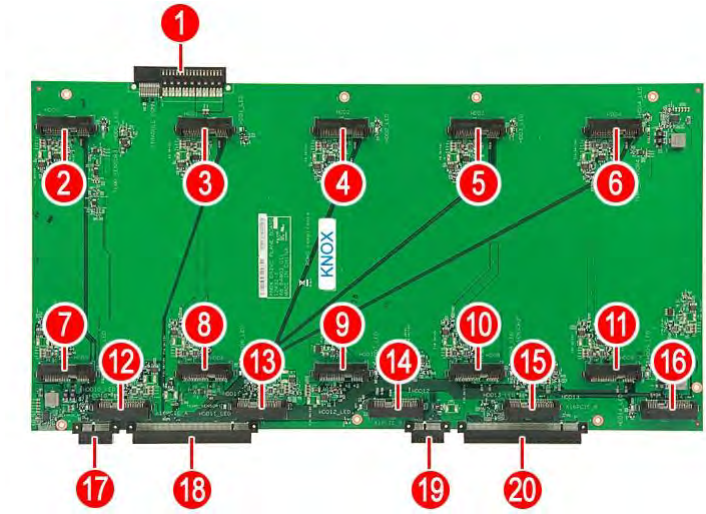
Item	LED Indicator	LED Color	LED State	Status
1	External Mini SAS LED		Solid Blue	SAS Links Healthy
			Solid Red	Loss of SAS Links
			Off	No SAS Links
2	Internal Mini SAS LED		Solid Blue	SAS Links Healthy
3			Solid Red	Loss of SAS Links
			Off	No SAS Links
4	Enclosure Status LED		Solid Blue	Normal System Operation
			Solid Red	Any Error in Whole Enclosure

2.5 SAS Expansion Board



Item	Connector	Description
1	EXT SAS CONN	External Mini SAS Connector
2	INTA SAS CONN	Internal Mini SAS Connector A
3	INTB SAS CONN	Internal Mini SAS Connector B
4	DEBUG	Debug Header
5	PCIE CONN	PCIE Connector to Drive Plane Board

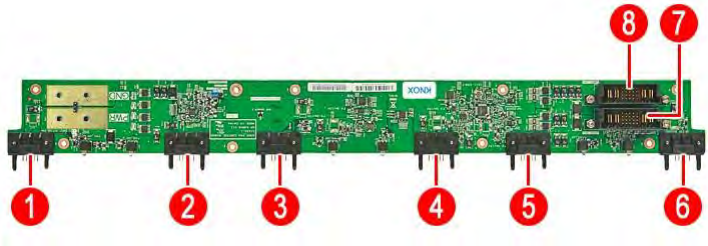
2.6 Drive Plane Board



Item	Connector	Description
1	STRADDLE CONN	Straddle Connector
2	HDD0	HDD0 Connector
3	HDD1	HDD1 Connector
4	HDD2	HDD2 Connector
5	HDD3	HDD3 Connector
6	HDD4	HDD4 Connector
7	HDD5	HDD5 Connector
8	HDD6	HDD6 Connector

Item	Connector	Description
9	HDD7	HDD7 Connector
10	HDD8	HDD8 Connector
11	HDD9	HDD9 Connector
12	HDD10	HDD10 Connector
13	HDD11	HDD11 Connector
14	HDD12	HDD12 Connector
15	HDD13	HDD13 Connector
16	HDD14	HDD14 Connector
17	X1PCIE_A	PCIE X1 Connector A
18	X16PCIE_A	PCIE X16 Connector A
19	X1PCIE_B	PCIE X1 Connector B
20	X16PCIE_B	PCIE X16 Connector B

2.7 Fan Controller Board



Item	Connector	Description
1	FAN HEADER 1	Fan 1 Connector
2	FAN HEADER 2	Fan 2 Connector
3	FAN HEADER 3	Fan 3 Connector
4	FAN HEADER 4	Fan 4 Connector
5	FAN HEADER 5	Fan 5 Connector
6	FAN HEADER 6	Fan 6 Connector
7	CN9	Power Cable Connector 1
8	CN10	Power Cable Connector 2

3. System Upgrades

3.1 Safety instructions

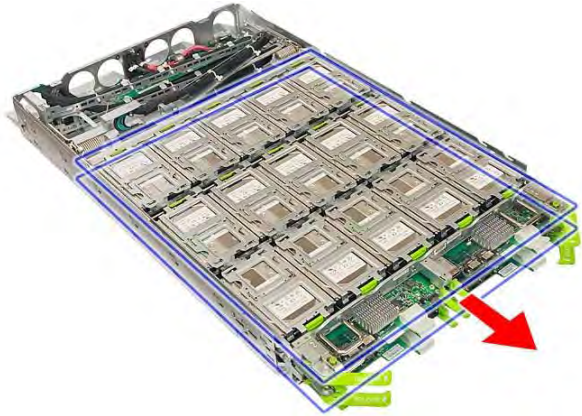
Read these instructions carefully. Keep this document for future reference. Follow all warnings and instructions for your safety and to avoid damaging the system.

1 Use both hands on the Tray Handles at all times and keep the HDD tray in the horizontal position when pulling it out or pushing it in to avoid damaging the HDDs and SAS Expander Boards.

2 To avoid any injury, do not hold and use the latches or other parts of the HDD Tray to pull out or push it in.

3 For safety reason, after pulling out the HDD tray, keep holding the tray handles to prevent the HDD tray from dropping.

4 HDD latches on the HDD tray may pop out if systems are inappropriately handled during transport, for example, if it dropped upside down. This will prevent you from pulling out the upper or lower HDD tray alone. To fix this, you need to pull out the two HDD tray together, find the HDD latches that popped out and press them back into place. If you still cannot pull out the HDD tray, DO NOT FORCE IT and contact Customer Service for assistance.



5 When pulling the system out of the rack for doing system upgrade, maintenance, and debug, make sure to always place the system in a flat rigid surface.

Caution: DO NOT place the system on a foam pad or other non-rigid surface; doing so may cause the chassis to warp, damaging the SAS Expander Boards and damaging the drive plane board connectors while pulling out the HDD tray.

6 Before you pull out one HDD Tray, make sure the other HDD Tray is latched and secured by latch handles.

7 CAUTION: THE POWER SUPPLIES IN YOUR SYSTEM HAVE ENERGY HAZARDS, WHICH CAN CAUSE BODILY HARM. UNLESS YOU ARE INSTRUCTED OTHERWISE, ONLY TRAINED SERVICE TECHNICIANS ARE AUTHORIZED TO REMOVE THE COVERS AND ACCESS ANY OF THE COMPONENTS INSIDE THE SYSTEM.
Remove the power before execute below item:
- Replacing the Power cable; or
- Replacing the Bus Bar Cables; or
- Replacing the Fan Controller Board

3.2 Recommended Tools

In performing the disassembly and assembly process, you will need the following tools:

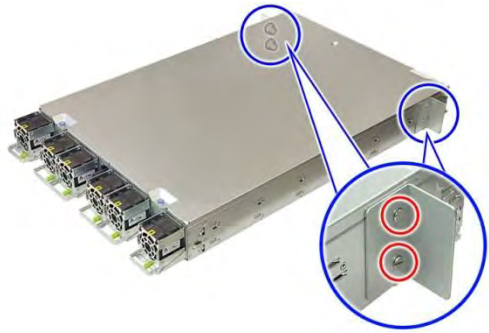
- Philips screwdriver
- Flat screwdriver
- Torx screwdriver

3.3 Replacing the Side Ear Brackets

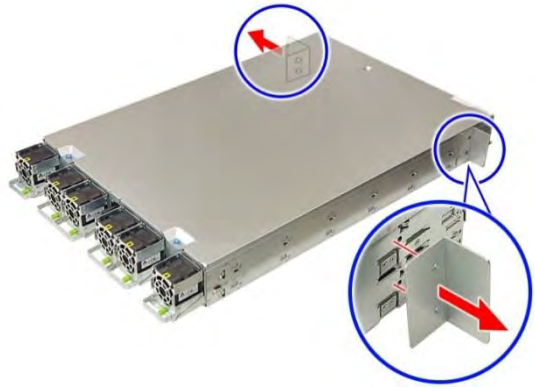
The system is shipped with two side ear brackets installed as a safety precaution during transport. Remove the brackets before installing the system in its rack.

3.3.1 Removing the Side Ear Brackets

1 Remove the four screws securing the side ear brackets to the chassis.

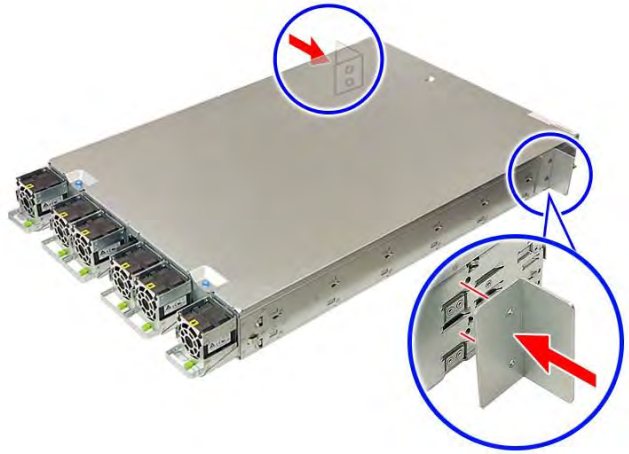


2 Detach the two side ear brackets from the chassis.

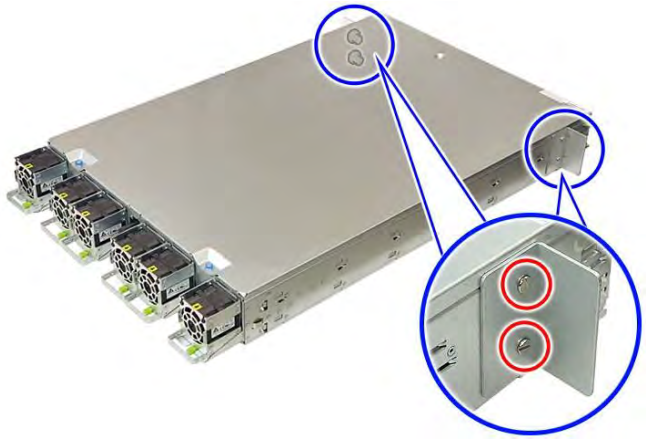


3.3.2 Installing the Side Ear Brackets

1 Place the two side ear brackets into the chassis.



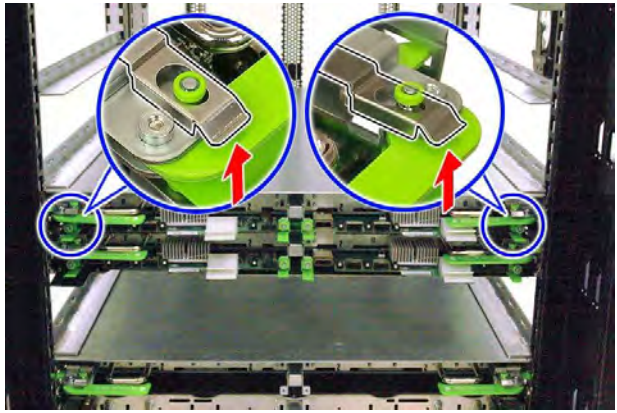
2 Secure the side ear brackets to the chassis by using four screws. Tighten screws using 1.0 kgf-cm torque. Do not over-tighten screws; damage to the HDD trays may result.



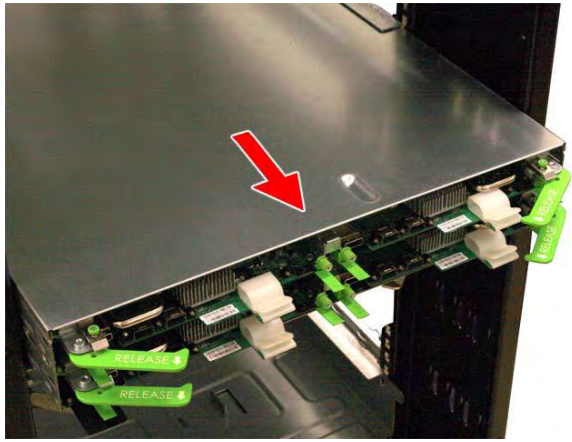
3.4 Replacing the System

3.4.1 Removing the System from the Rack

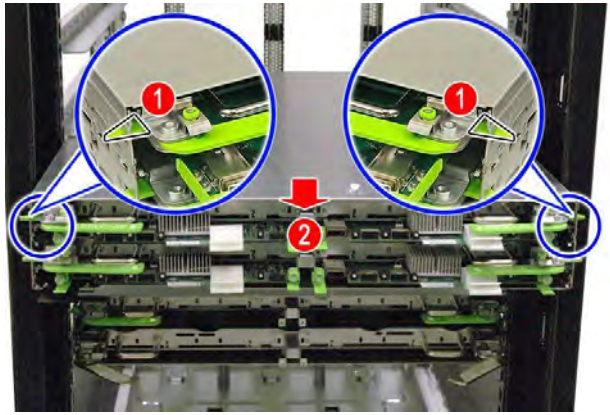
1 Lift the tabs to release the latch handles that secure the two HDD trays to the chassis.



2 Slide the system slowly out of the rack using two hands.



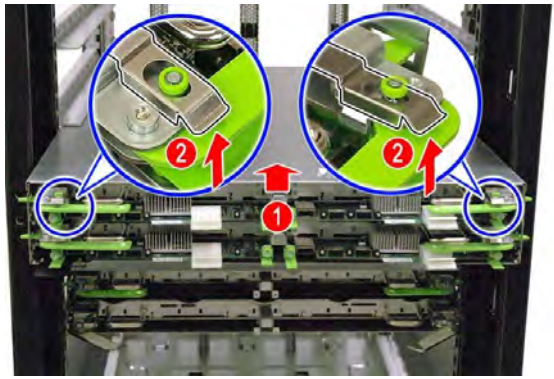
3 When the latch handles clear the rack posts, return the latch handles to the lock position (**1**), then slide the system out of the rack (**2**).



Caution: The system is very heavy. Use a server lift or at least two people to lift the system into or from the rack.

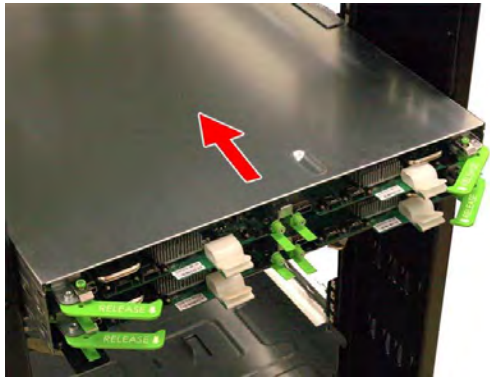
3.4.2 Installing the System into the Rack

1 Insert the system into the chassis (**1**) then lift the tabs to release the latch handles (**2**).

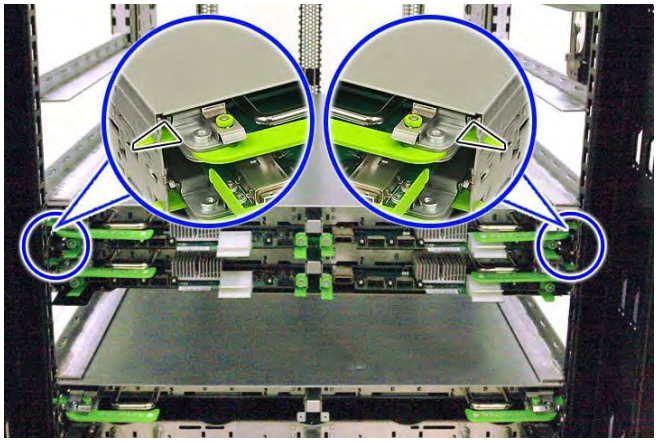


Caution: The system is very heavy. Use a server lift or at least two people to lift the system into or from the rack.

2 Push the system into the chassis.



3 Push the latch handles until they lock into place.

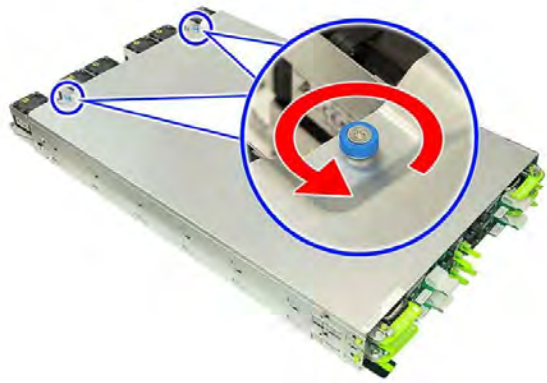


3.5 Opening the System

3.5.1 Removing the Top Cover

1 Remove the System from the Rack (see **Removing the System from the Rack** on page **20**).

2 Loosen the two thumbscrews securing the top cover to the chassis.

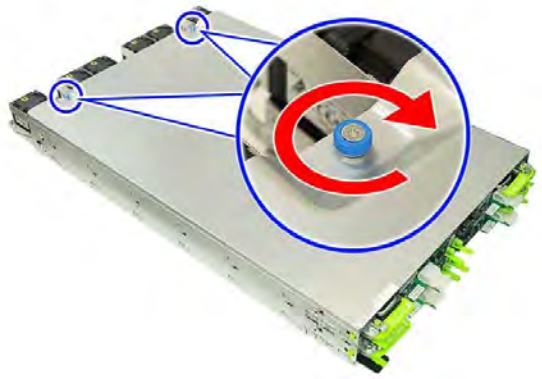


3 Slide the top cover towards the rear and lift it off the chassis.

3.5.2 Installing the Top Cover

1 Lower the top cover onto the chassis and slide it towards the front until the thumbscrews are aligned with the screw holes.

2 Secure the top cover to the chassis by tightening the two thumbscrews.



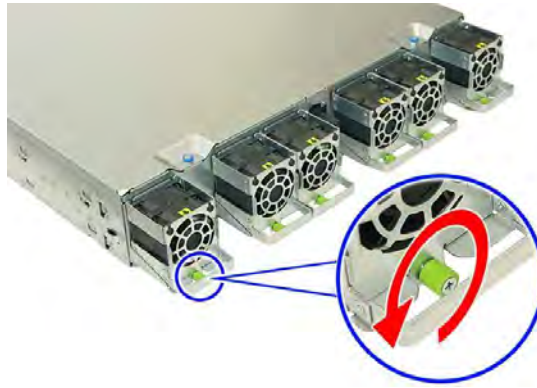
3 Install the System into the Rack (see **Installing the System into the Rack** on **page 22**).

3.6 Replacing the System Fans

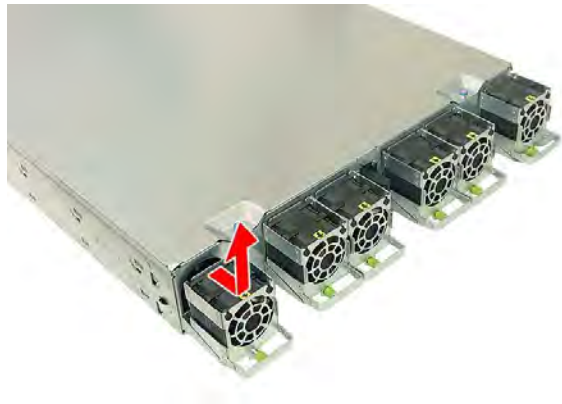
3.6.1 Removing the Fan Module

1 Remove the System from the Rack (see **Removing the System from the Rack** on page **20**).

2 Loosen the thumbscrew securing the fan module to the chassis.



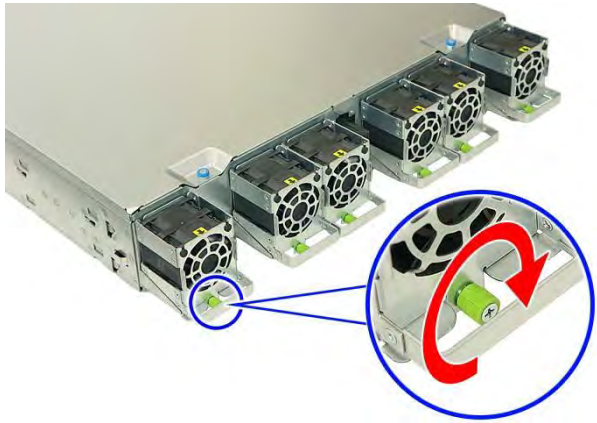
3 Pull out the fan module and lift it off the chassis.



3.6.2 Installing the Fan Module

1 Insert the fan module into the chassis.

2 Secure the fan module to the chassis by tightening the thumbscrew.

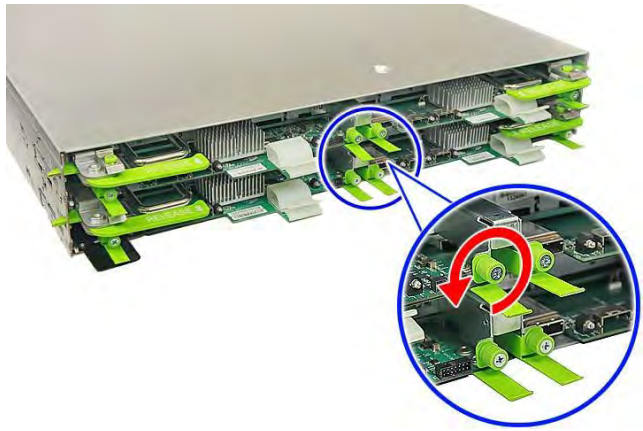


3 Install the System into the Rack (see **Installing the System into the Rack** on **page 22**).

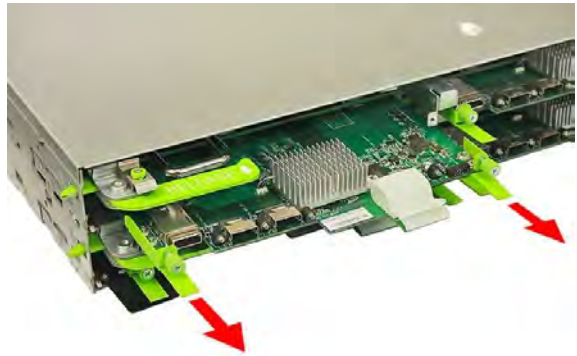
3.7 Replacing the SAS Expander Boards

3.7.1 Removing the SAS Expander Board

1 Loosen the thumbscrew securing the SAS Expander Board to the HDD tray.

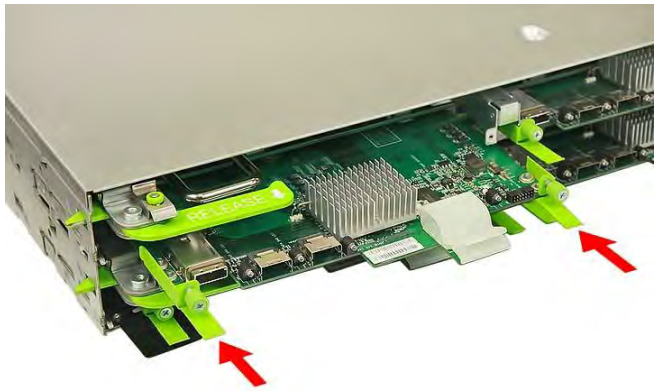


2 Use the two tabs to pull out the SAS Expander Board from the HDD tray.

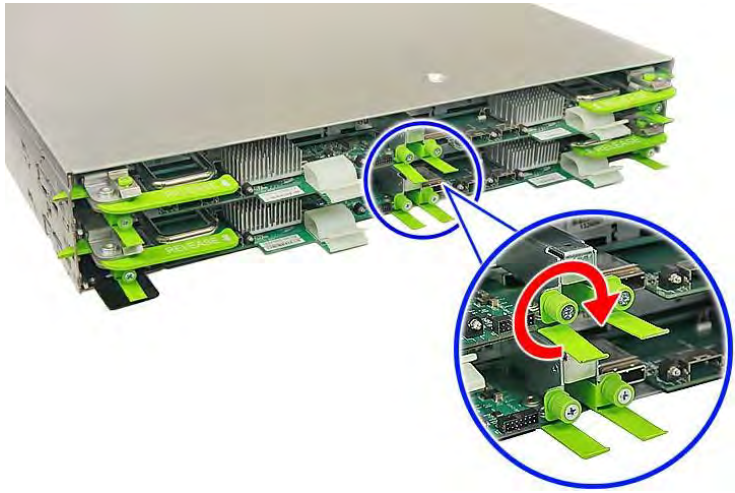


3.7.2 Installing the SAS Expander Board

1 Insert the SAS Expander Board into the HDD tray.



2 Secure the SAS Expander Board to the HDD tray by tightening the thumbscrew. Note that only the inboard thumbscrews are used; the thumbscrews under the release levers are not screwed into the tray.

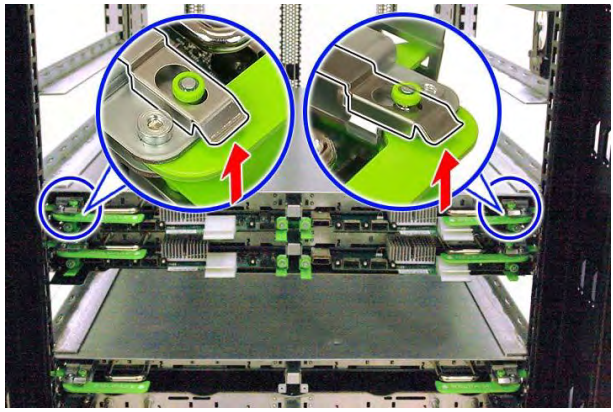


3.8 Replacing the Hard Disk Drives

3.8.1 Removing the Hard Disk Drive

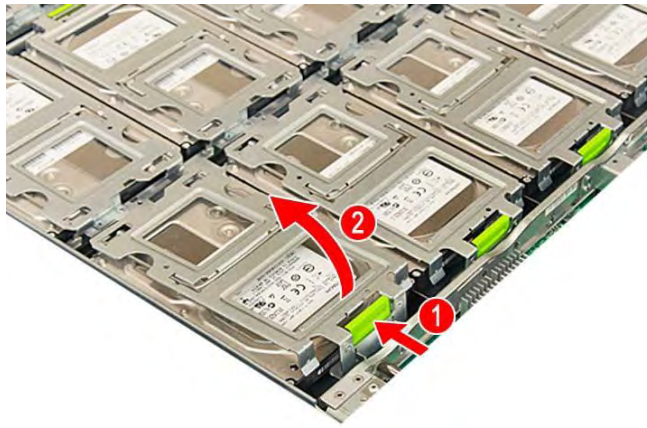
For 3.5” Hard Disk Drive

1 Lift the tabs to release the latch handles that secure the HDD tray to the chassis.

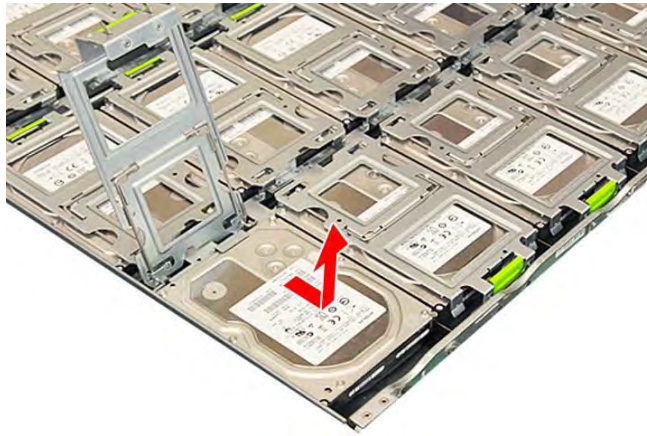


2 Pull out the HDD tray from the chassis using both hands.

3 Press the latch that secures the HDD cover to the tray (**1**) and lift up the HDD cover (**2**).

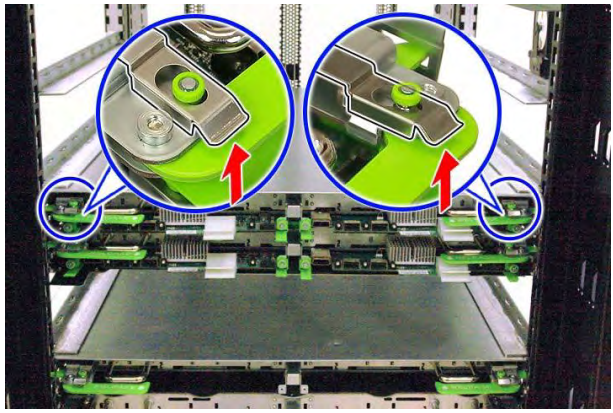


4 Slide the HDD to disengage it from its connector and remove the HDD from the HDD tray.



For 2.5” Disk Drive

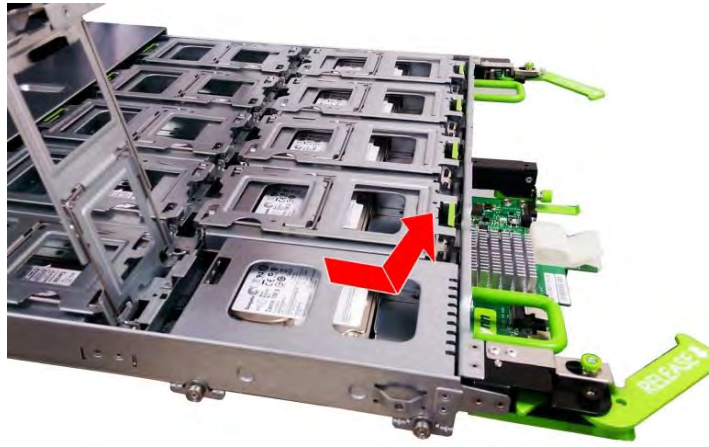
1 Lift the tabs to release the latch handles that secure the HDD tray to the chassis.



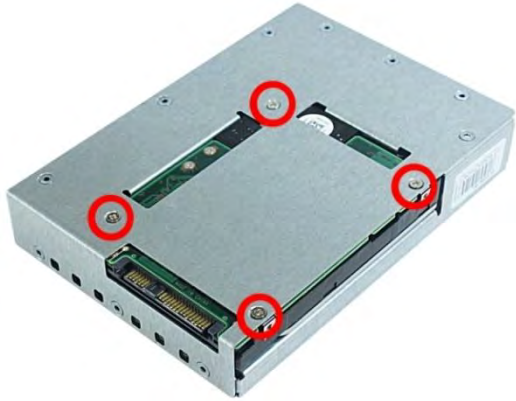
2 Pull out the HDD tray from the chassis using both hands.

3 Press the latch that secures the HDD cover to the tray (**1**) and lift up the HDD cover (**2**).

4 Slide the 3.5“ drive cage to disengage the drive from its connector. Lift and remove the drive cage from the HDD tray.



5 Turn over the drive cage so that the bottom side is facing up. Remove the four screws that secures the 2.5“ HDD or SSD to the cage.



6 Remove the 2.5“ HDD or SSD from the drive cage.

HDD

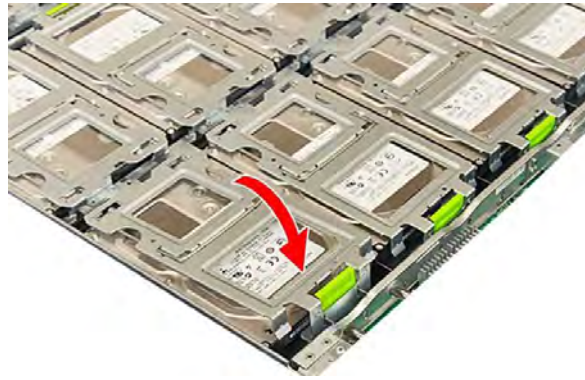
SSD

3.8.2 Installing the Hard Disk Drive

For 3.5” Hard Disk Drive

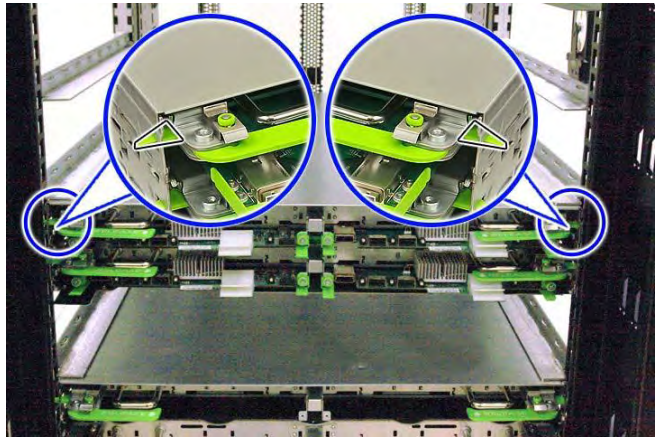
1 Insert the HDD into the tray and slide it toward the connector until it latches into place.

2 Pull down the HDD cover until it latches into place. **DO NOT** slam the HDD cover in place – apply pressure to the green latch while pushing the cover downwards, then release the green latch to engage the tray. Pushing the cover into place without doing this may result in shock which may damage neighboring HDDs. Applying pressure to the HDD cover will cause unbalanced force, this may result in latch non- engagement to the tray.



3 Push the HDD tray into the chassis using both hands.

4 Press the HDD tray into the chassis until the handles latch into place.



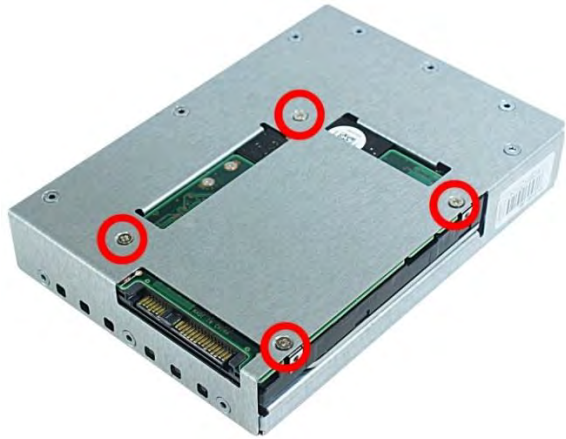
For 2.5” Disk Drive

1 Insert the 2.5“ HDD or SSD into the 3.5“ drive cage.

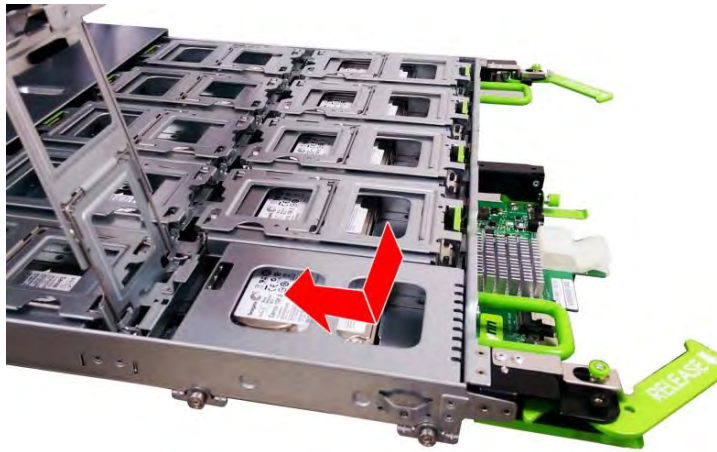
HDD

SSD

2 Turn over the drive cage so that the bottom side is facing up. Secure the 2.5“ HDD or SSD to the cage using four screws.



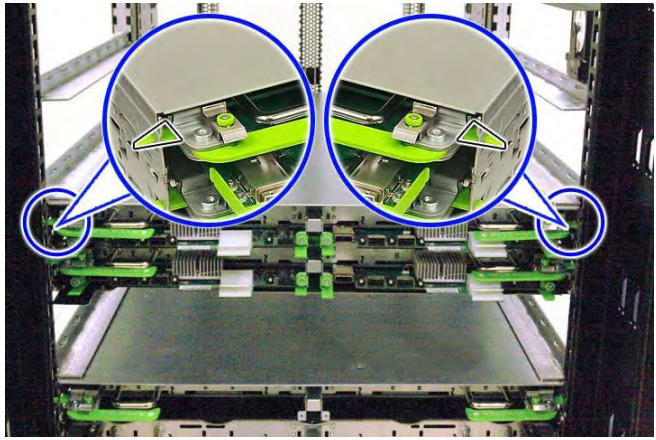
3 Insert the 3.5“ drive cage into the tray and slide it toward the connector until the drive latches into place.



4 Pull down the HDD cover until it latches into place. **DO NOT** slam the HDD cover in place – apply pressure to the green latch while pushing the cover downwards, then release the green latch to engage the tray. Pushing the cover into place without doing this may result in shock which may damage neighboring HDDs. Applying pressure to the HDD cover will cause unbalanced force, this may result in latch non- engagement to the tray.

5 Push the HDD tray into the chassis using both hands.

6 Press the HDD tray into the chassis until the handles latch into place.



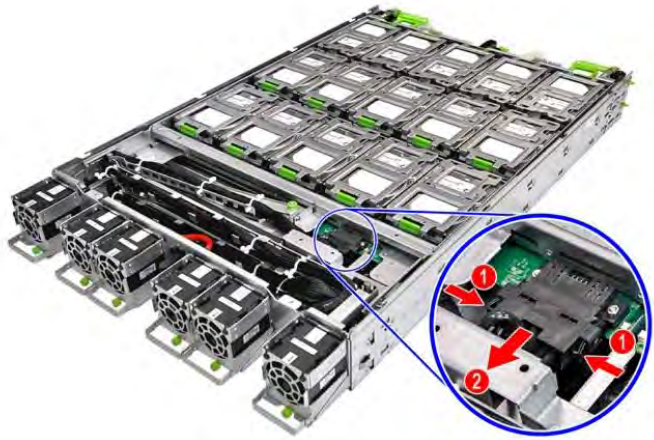
3.9 Replacing the Power Cable

3.9.1 Removing the Power Cable

1 Remove the System from the Rack (see Removing the System from the Rack on page 20).

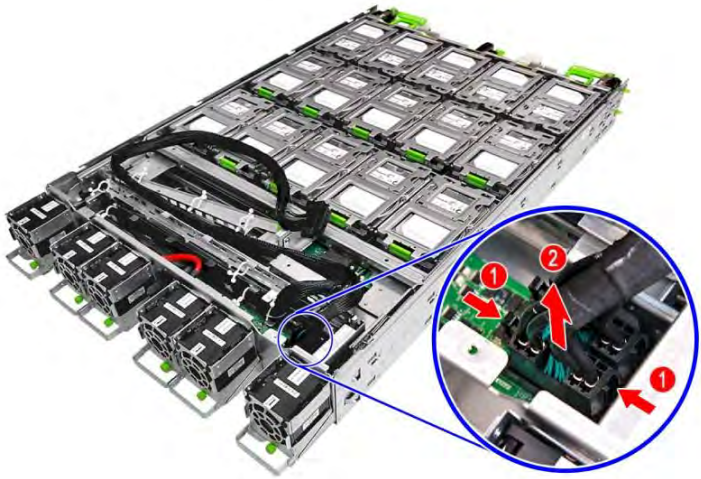
2 Remove the Top Cover (see **Removing the Top Cover** on **page 24**).

3 Disconnect the power cable from the Drive Plane Board.



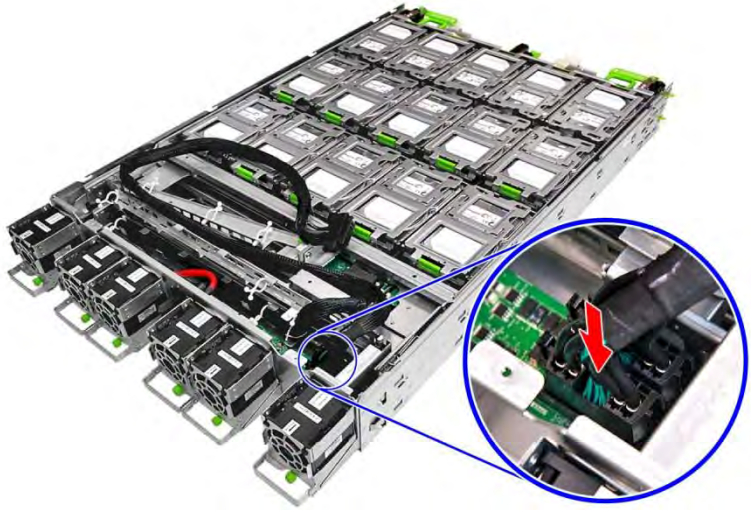
4 Remove the cable clips that secure the power cable to the guide rail.

5 Disconnect the power cable from the Fan Controller Board.



3.9.2 Installing the Power Cable

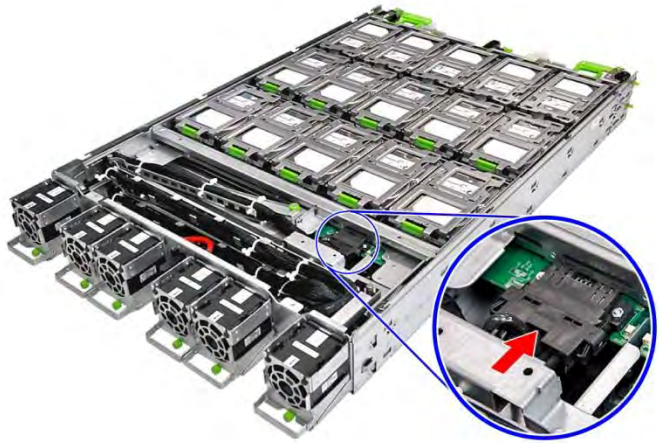
1 Connect the power cable to the Fan Controller Board.



2 Secure the power cable to the guide rail using cable clips.

Note: Make sure that the green cables are placed at the upper side of the guard rail housing.

3 Connect the power cable to the Drive Plane Board.



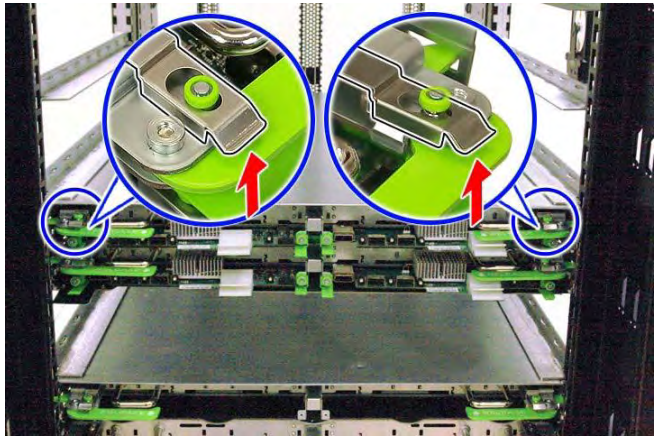
4 Install the Top Cover (see **Installing the Top Cover** on **page 25**).

5 Install the System into the Rack (see **Installing the System into the Rack** on **page 22**).

3.10 Replacing the HDD Tray

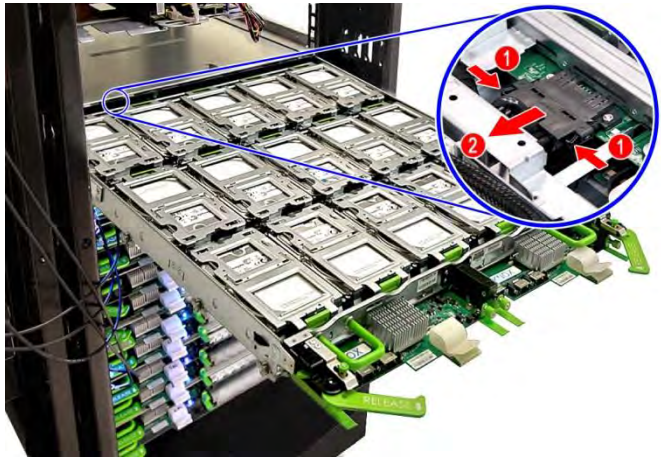
3.10.1 Removing the HDD Tray

1 Lift the tabs to release the latch handles that secure the HDD tray to the chassis.

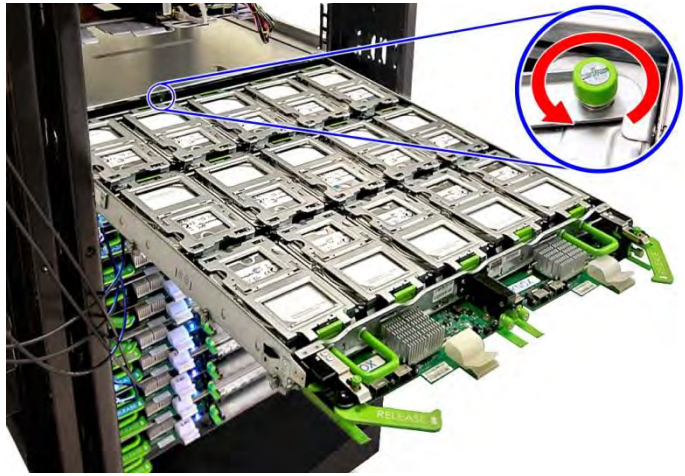


2 Pull out the HDD tray from the chassis using both hands.

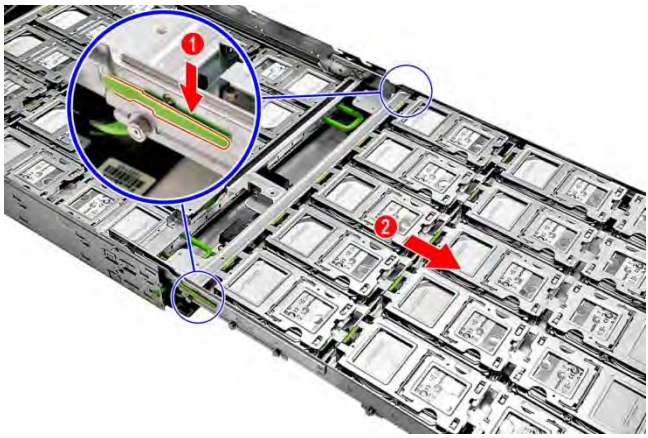
3 Disconnect the power cable from the Drive Plane Board.



4 Loosen the thumbscrew securing the HDD tray to the guide rail.

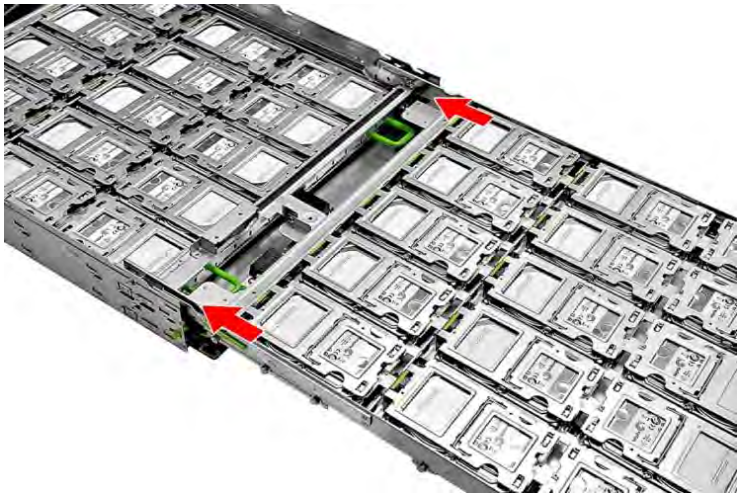


5 Disengage the two safety latches that secure the HDD tray to the chassis (1), then pull the HDD tray off the chassis (2). If the latches do not both push completely downwards, or if the HDD tray cannot be pulled out, push it back into the chassis approximately 1/8” (3mm) and try again.

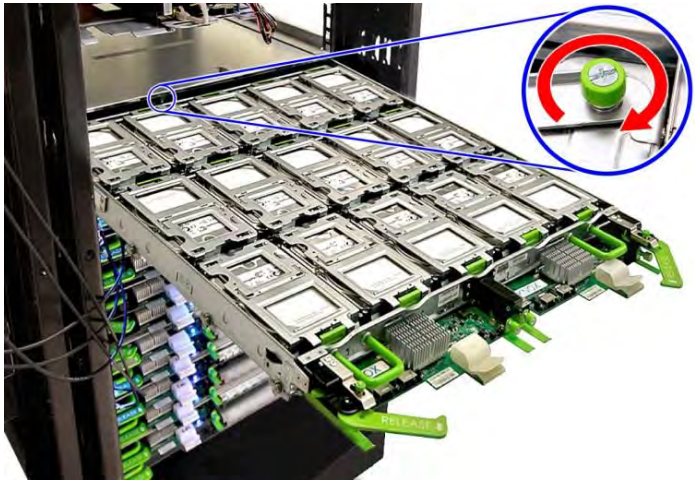


3.10.2 Installing the HDD Tray

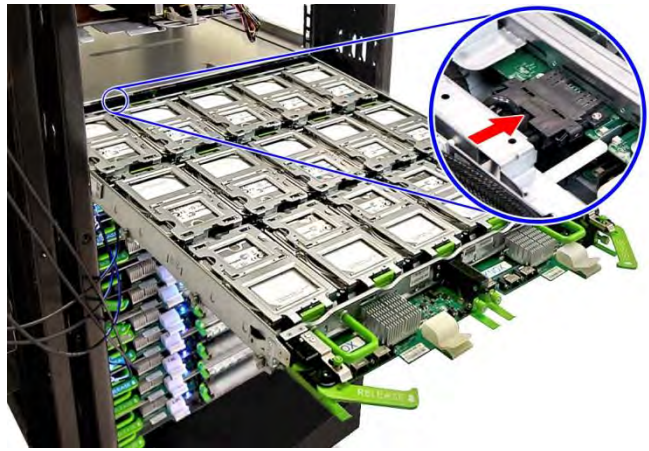
1 Insert the HDD tray into the chassis, making sure the sliders are properly aligned with the rails in the chassis.



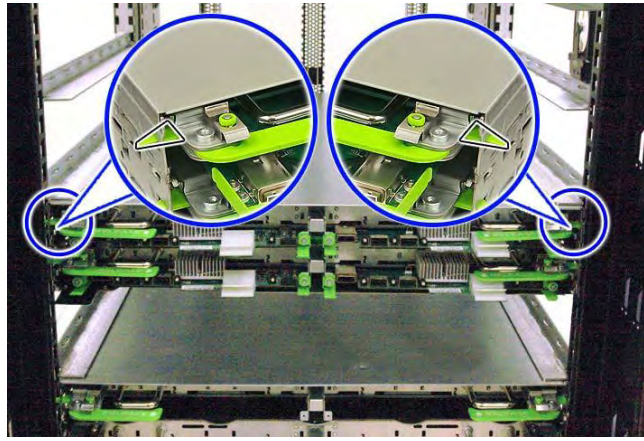
2 Secure the HDD tray to the guide rail by tightening the thumbscrew.



3 Connect the power cable to the Drive Plane Board.



4 Press the HDD tray into the chassis until the handles latch into place.



3.11 Replacing the Bus Bar Cables

3.11.1 Removing the Bus Bar Cables

1 Remove the System from the Rack (see **Removing the System from the Rack** on **page 20**).

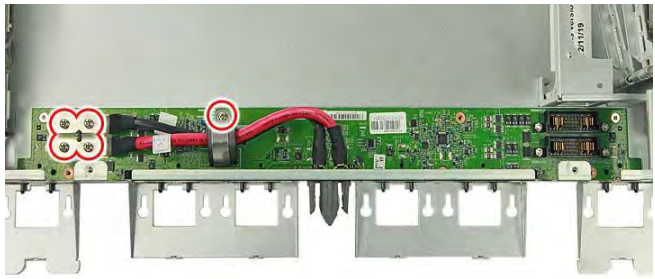
2 Remove the Top Cover (see **Removing the Top Cover** on **page 24**).

3 Remove the Fan Modules (see **Removing the Fan Module** on **page 26**).

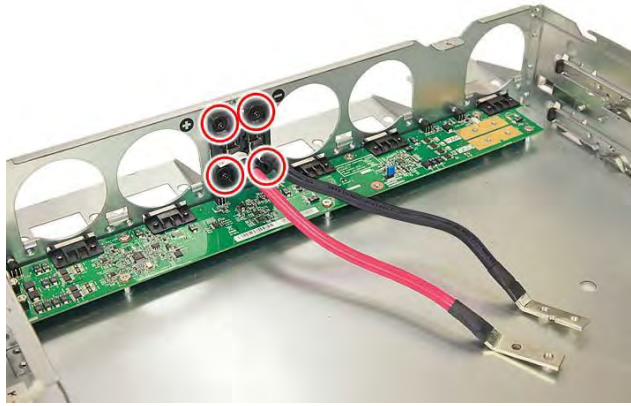
4 Remove the Power Cables (see **Removing the Power Cable** on **page 41**).

5 Remove the HDD Trays (see **Removing the HDD Tray** on **page 45**).

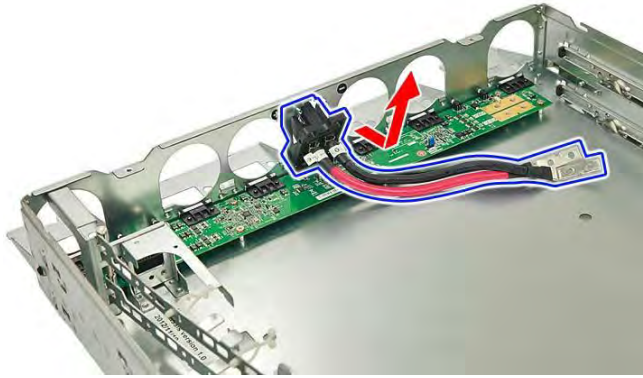
6 Remove the five screws securing the Bus Bar Cables to the Fan Controller Board.



7 Using a torx screw driver, remove the four torx screws securing the Bus Bar Cables to the chassis.

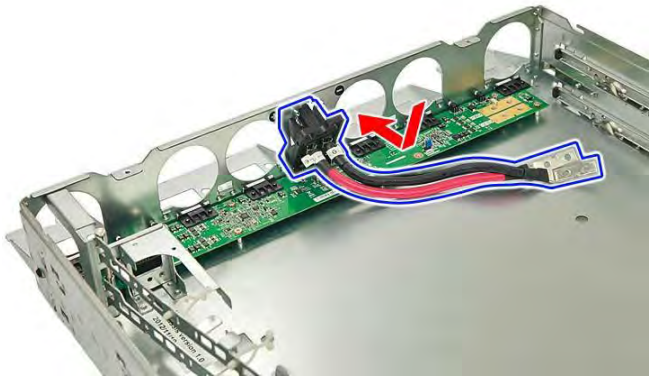


8 Lift the Bus Bar Cables off the chassis.

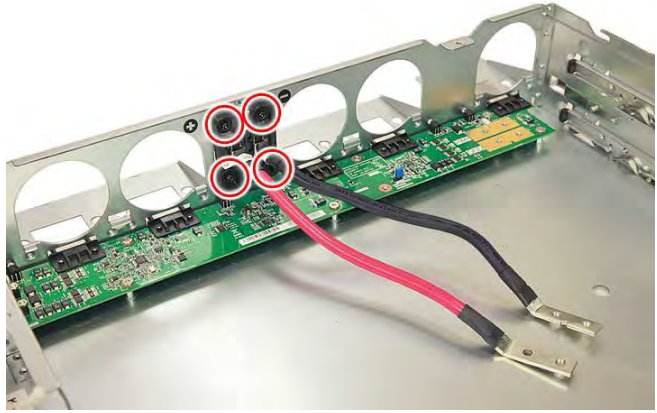


3.11.2 Installing the Bus Bar Cables

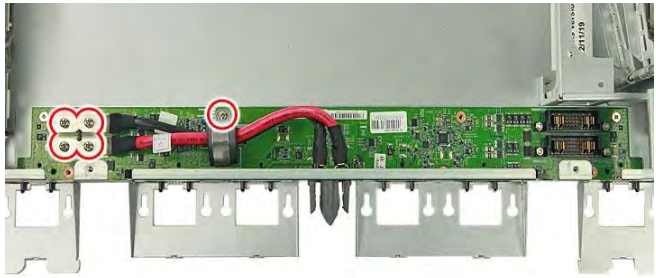
1 Place the Bus Bar Cables into the chassis.



2 Using a torx screw driver, secure the Bus Bar Cables to the chassis with four torx screws.



3 Secure the Bus Bar Cables to the Fan Controller Board using five screws.



4 Install the HDD Trays (see **Installing the HDD Tray** on **page 48**).

5 Install the Power Cables (see **Installing the Power Cable** on **page 43**).

6 Install the Fan Modules (see **Installing the Fan Module** on **page 27**).

7 Install the Top Cover (see **Installing the Top Cover** on **page 25**).

8 Install the System into the Rack (see **Installing the System into the Rack** on **page 22**).

3.12 Replacing the Fan Controller Board

3.12.1 Removing the Fan Controller Board

1 Remove the System from the Rack (see **Removing the System from the Rack** on **page 20**).

2 Remove the Top Cover (see **Removing the Top Cover** on **page 24**).

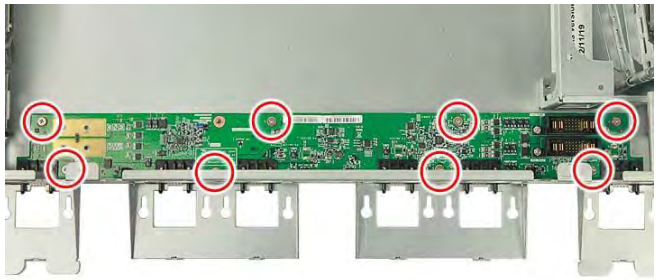
3 Remove the Fan Modules (see **Removing the Fan Module** on **page 26**).

4 Remove the Power Cables (see **Removing the Power Cable** on **page 41**).

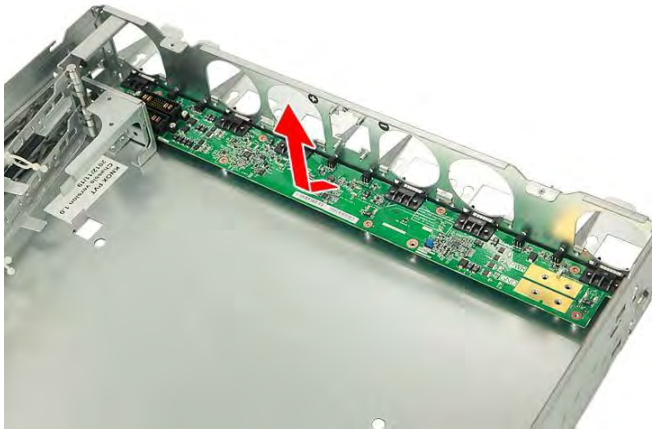
5 Remove the HDD Trays (see **Removing the HDD Tray** on **page 45**).

6 Remove the Bus Bar Cables (see **Removing the Bus Bar Cables** on **page 50**).

7 Remove the eight screws securing the Fan Controller Board to the chassis.

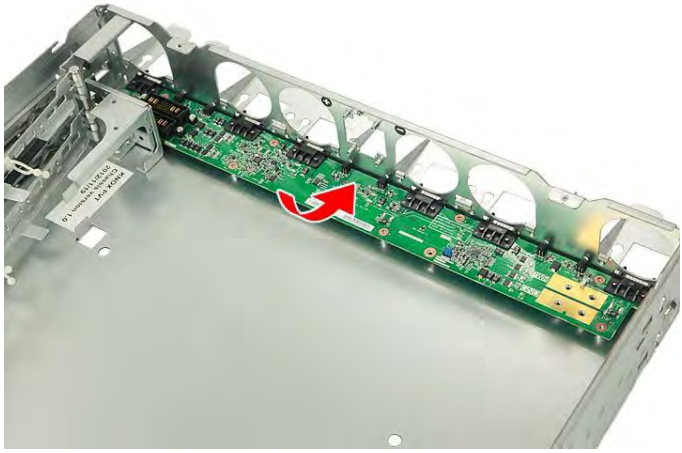


8 Lift the Fan Controller Board off the chassis.

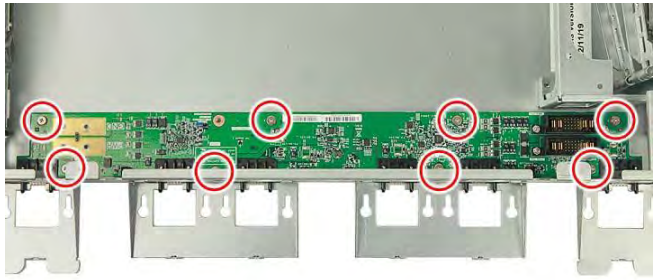


3.12.2 Installing the Fan Controller Board

1 Place the Fan Controller Board into the chassis.



2 Secure the Fan Controller Board to the chassis using eight screws.



3 Install the Bus Bar Cables (see **Installing the Bus Bar Cables** on **page 52**).

4 Install the HDD Trays (see **Installing the HDD Tray** on **page 48**).

5 Install the Power Cables (see **Installing the Power Cable** on **page 43**).

6 Install the Fan Modules (see **Installing the Fan Module** on **page 27**).

7 Install the Top Cover (see **Installing the Top Cover** on **page 25**).

8 Install the System into the Rack (see **Installing the System into the Rack** on **page 22**).

3.13 Replacing the Power Transition Board

3.13.1 Removing the Power Transition Board

1 Remove the SAS Expander Boards (see **Removing the SAS Expander Board** on **page 28**).

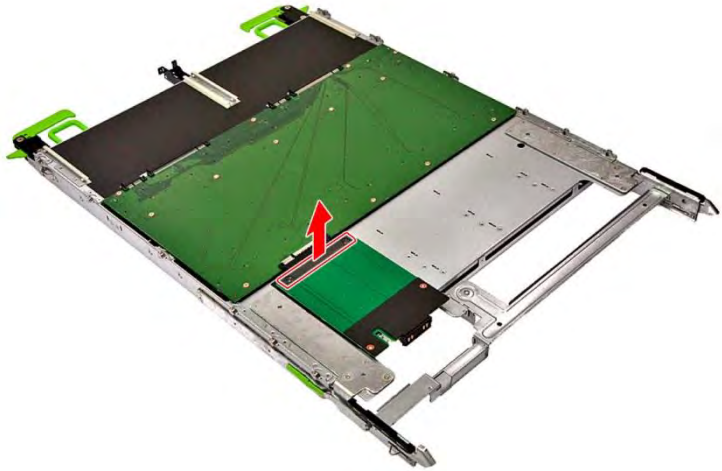
2 Remove the Hard Disk Drives (see **Removing the Hard Disk Drive** on **page 30**).

3 Remove the HDD Trays (see **Removing the HDD Tray** on **page 45**).

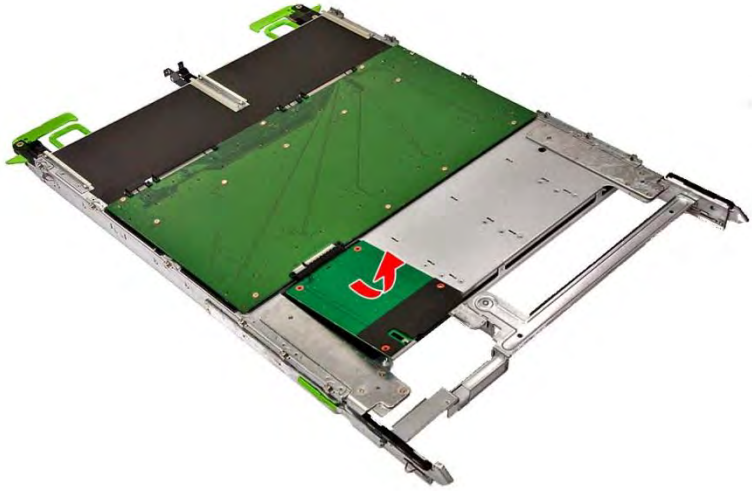
4 Turn the tray over to access the base of the tray.

5 Remove the four screws securing the Power Transition Board to the chassis.

6 Detach the plastic ramp from the Power Transition Board.

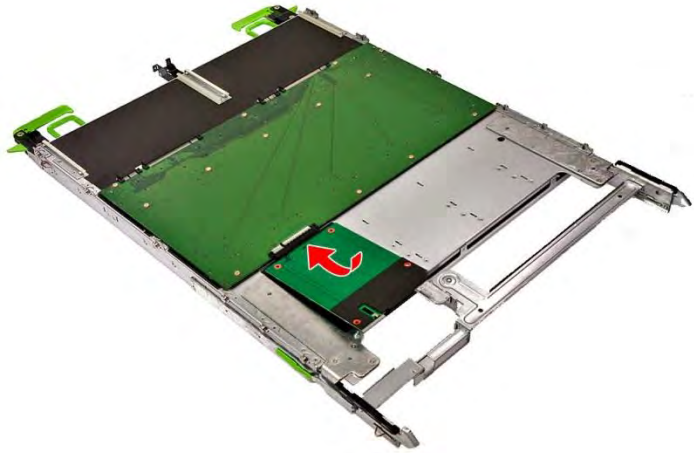


7 Slide the Power Transition Board to disengage it from the Drive Plane Board, then lift it off the chassis.



3.13.2 Installing the Power Transition Board

1 Insert the Power Transition Board into the chassis and slide it toward the Drive Plane Board until it latches into place.



2 Place the plastic ramp into the Power Transition Board.

3 Secure the Power Transition Board to the chassis using four screws.

4 Install the HDD Trays (see **Installing the HDD Tray** on **page 48**).

5 Install the Hard Disk Drives (see **Installing the Hard Disk Drive** on **page 35**).

6 Install the SAS Expander Boards (see **Installing the SAS Expander Board** on **page 29**).

3.14 Replacing the Drive Plane Board

3.14.1 Removing the Drive Plane Board

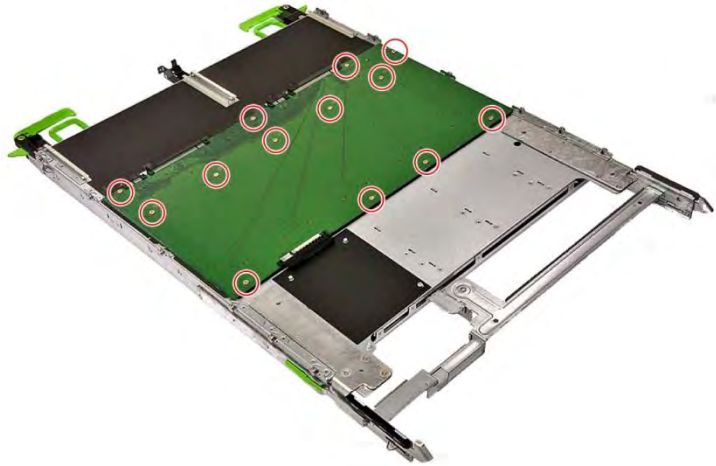
1 Remove the SAS Expander Boards (see **Removing the SAS Expander Board** on **page 28**).

2 Remove the Hard Disk Drives (see **Removing the Hard Disk Drive** on **page 30**).

3 Remove the HDD Trays (see **Removing the HDD Tray** on **page 45**).

4 Remove the Power Transition Board (see **Removing the Power Transition Board** on **page 57**).

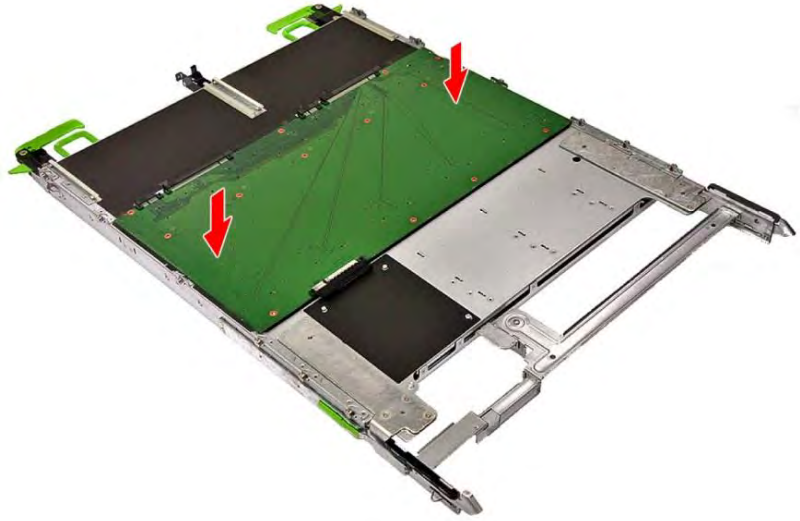
5 Remove the thirteen screws securing the Drive Plane Board to the chassis.



6 Remove the Drive Plane Board from the chassis

3.14.2 Installing the Drive Plane Board

1 Place the Drive Plane Board into the chassis.



2 Secure the Drive Plane Board to the chassis using thirteen screws.

3 Install the Power Transition Board (see **Installing the Power Transition Board** on **page 59**).

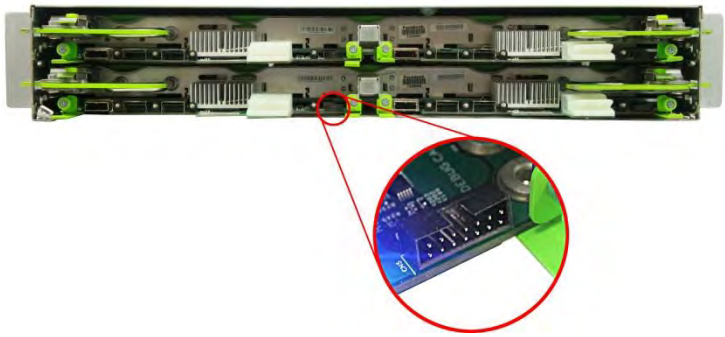
4 Install the HDD Trays (see **Installing the HDD Tray** on **page 48**).

5 Install the Hard Disk Drives (see **Installing the Hard Disk Drive** on **page 35**).

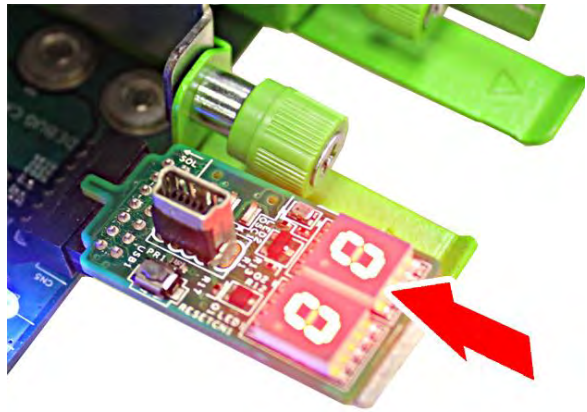
6 Install the SAS Expander Boards (see **Installing the SAS Expander Board** on **page 29**).

3.15 Installing the Debug Card

1 Locate the port for installing the debug card.



2 Install the debug card.



3 Connect the the serial cable from the debug card to any USB port on your computer.

4. Wiwynn Supported SES Pages

Wiwynn SAS Expander firmware follows SES (SCSI Enclosure Services) standard so that supported SES pages can be retrieved by opening source utility such as Linux sg_ses tool.

The following examples show you how to retrieve the status of some SES pages via Linux sg_ses tool.

1. Get the status of SES page0

[root@localhost ~]# sg_ses -p 0 /dev/sg1

Wiwynn Knox2U 135

Supported diagnostic pages:

Supported Diagnostic Pages [sdp] [0x0]
Configuration (SES) [cf] [0x1]
Enclosure Status/Control (SES) [ec,es] [0x2]
String In/Out (SES) [str] [0x4]
Threshold In/Out (SES) [th] [0x5]
Element Descriptor (SES) [ed] [0x7]
Additional Element Status (SES-2) [aes] [0xa]
Download Microcode (SES-2) [dm] [0xe]

2. Get the status of SES page1

[root@localhost ~]# sg_ses -p 1 /dev/sg1

```
    Wiwynn   Knox2U                  135
Configuration diagnostic page:
  number of secondary subenclosures: 0
  generation code: 0x0
  enclosure descriptor list
    Subenclosure identifier: 0 (primary)
      relative ES process id: 1, number of ES processes: 1
      number of type descriptor headers: 8
      enclosure logical identifier (hex): 5f80f4185702a0ff
      enclosure vendor: Wiwynn product: Knox2U                rev: 1300
      vendor-specific data:
        11 22 33 44 55 00 00 00
  type descriptor header/text list
    Element type: Array device slot, subenclosure id: 0
      number of possible elements: 15
      text: ArrayDevicesInSubEnclsr0
    Element type: SAS connector, subenclosure id: 0
      number of possible elements: 20
      text: ConnectorsInSubEnclsr0
    Element type: Cooling, subenclosure id: 0
      number of possible elements: 12
      text: CoolingElementInSubEnclsr0
    Element type: Temperature sensor, subenclosure id: 0
      number of possible elements: 29
      text: TempSensorsInSubEnclsr0
    Element type: Voltage sensor, subenclosure id: 0
      number of possible elements: 12
      text: VoltageSensorsInSubEnclsr0
    Element type: Current sensor, subenclosure id: 0
      number of possible elements: 1
      text: CurrentSensorsInSubEnclsr0
    Element type: Enclosure, subenclosure id: 0
      number of possible elements: 1
      text: EnclosureElementInSubEnclsr0
    Element type: SAS expander, subenclosure id: 0
```

number of possible elements: 1
text: SAS Expander

3. Get the status of SES page2

[root@localhost ~]# sg_ses -p 2 /dev/sg1

```
  Wiwynn   Knox2U                  135
  Primary enclosure logical identifier (hex): 5f80f4185702a0ff
Enclosure Status diagnostic page:
  INVOP=0, INFO=1, NON-CRIT=0, CRIT=0, UNRECOV=0
  generation code: 0x0
  status descriptor list
    Element type: Array device slot, subenclosure id: 0 [ti=0]
      Overall descriptor:
        Predicted failure=0, Disabled=0, Swap=0, status: Unsupported
        OK=0, Reserved device=0, Hot spare=0, Cons check=0
        In crit array=0, In failed array=0, Rebuild/remap=0, R/R abort=0
        App client bypass A=0, Do not remove=0, Enc bypass A=0, Enc bypass B=0
        Ready to insert=0, RMV=0, Ident=0, Report=0
        App client bypass B=0, Fault sensed=0, Fault reqstd=0, Device off=0
        Bypassed A=0, Bypassed B=0, Dev bypassed A=0, Dev bypassed B=0
      Element 0 descriptor:
        Predicted failure=0, Disabled=0, Swap=0, status: OK
        OK=1, Reserved device=0, Hot spare=0, Cons check=0
        In crit array=0, In failed array=0, Rebuild/remap=0, R/R abort=0
        App client bypass A=0, Do not remove=0, Enc bypass A=0, Enc bypass B=0
        Ready to insert=0, RMV=0, Ident=0, Report=0
        App client bypass B=0, Fault sensed=0, Fault reqstd=0, Device off=0
        Bypassed A=0, Bypassed B=0, Dev bypassed A=0, Dev bypassed B=0
      Element 1 descriptor:
        Predicted failure=0, Disabled=0, Swap=0, status: OK
        OK=1, Reserved device=0, Hot spare=0, Cons check=0
        In crit array=0, In failed array=0, Rebuild/remap=0, R/R abort=0
        App client bypass A=0, Do not remove=0, Enc bypass A=0, Enc bypass B=0
        Ready to insert=0, RMV=0, Ident=0, Report=0
        App client bypass B=0, Fault sensed=0, Fault reqstd=0, Device off=0
        Bypassed A=0, Bypassed B=0, Dev bypassed A=0, Dev bypassed B=0
```

```
.....
.....
Element type: SAS connector, subenclosure id: 0 [ti=1]
  Overall descriptor:
    Predicted failure=0, Disabled=0, Swap=0, status: Unsupported
    Ident=0, No information
    Connector physical link=0x0, Fail=0
  Element 0 descriptor:
    Predicted failure=0, Disabled=0, Swap=0, status: OK
    Ident=0, SAS Drive backplane receptacle (SFF-8482) [max 2 phys]
    Connector physical link=0x0, Fail=0
  Element 1 descriptor:
    Predicted failure=0, Disabled=0, Swap=0, status: OK
    Ident=0, SAS Drive backplane receptacle (SFF-8482) [max 2 phys]
    Connector physical link=0x0, Fail=0
  .....
  .....
  Element type: Cooling, subenclosure id: 0 [ti=2]
  Overall descriptor:
    Predicted failure=0, Disabled=0, Swap=0, status: Unsupported
    Ident=0, Hot swap=0, Fail=0, Requested on=0, Off=0
    Actual speed=0 rpm, Fan stopped
  Element 0 descriptor:
    Predicted failure=0, Disabled=0, Swap=0, status: OK
    Ident=0, Hot swap=0, Fail=0, Requested on=0, Off=0
    Actual speed=5350 rpm, Fan at intermediate speed
  Element 1 descriptor:
    Predicted failure=0, Disabled=0, Swap=0, status: OK
    Ident=0, Hot swap=0, Fail=0, Requested on=0, Off=0
    Actual speed=4650 rpm, Fan at intermediate speed
  .....
  .....
  Element type: Temperature sensor, subenclosure id: 0 [ti=3]
  Overall descriptor:
    Predicted failure=0, Disabled=0, Swap=0, status: Unsupported
    Ident=0, Fail=0, OT failure=0, OT warning=0, UT failure=0
    UT warning=0
    Temperature: <reserved>
```

```
Element 0 descriptor:
  Predicted failure=0, Disabled=0, Swap=0, status: OK
  Ident=0, Fail=0, OT failure=0, OT warning=0, UT failure=0
  UT warning=0
  Temperature=30 C
Element 1 descriptor:
  Predicted failure=0, Disabled=0, Swap=0, status: OK
  Ident=0, Fail=0, OT failure=0, OT warning=0, UT failure=0
  UT warning=0
  Temperature=32 C
......
......
Element type: Voltage sensor, subenclosure id: 0 [ti=4]
Overall descriptor:
  Predicted failure=0, Disabled=0, Swap=0, status: Unsupported
  Ident=0, Fail=0,   Warn Over=0, Warn Under=0, Crit Over=0
  Crit Under=0
  Voltage: 0.00 volts
Element 0 descriptor:
  Predicted failure=0, Disabled=0, Swap=0, status: OK
  Ident=0, Fail=0,   Warn Over=0, Warn Under=0, Crit Over=0
  Crit Under=0
  Voltage: 1.19 volts
Element 1 descriptor:
  Predicted failure=0, Disabled=0, Swap=0, status: OK
  Ident=0, Fail=0,   Warn Over=0, Warn Under=0, Crit Over=0
  Crit Under=0
  Voltage: 3.24 volts
......
......
Element type: Current sensor, subenclosure id: 0 [ti=5]
Overall descriptor:
  Predicted failure=0, Disabled=0, Swap=0, status: Unsupported
  Ident=0, Fail=0, Warn Over=0, Crit Over=0
  Current: 0.00 amps
Element 0 descriptor:
  Predicted failure=0, Disabled=0, Swap=0, status: OK
  Ident=0, Fail=0, Warn Over=0, Crit Over=0
```

```
        Current: 23.87 amps
    Element type: Enclosure, subenclosure id: 0 [ti=6]
      Overall descriptor:
        Predicted failure=0, Disabled=0, Swap=0, status: Unsupported
        Ident=0, Time until power cycle=0, Failure indication=0
        Warning indication=0, Requested power off duration=0
        Failure requested=0, Warning requested=0
      Element 0 descriptor:
        Predicted failure=0, Disabled=0, Swap=0, status: OK
        Ident=0, Time until power cycle=0, Failure indication=0
        Warning indication=0, Requested power off duration=0
        Failure requested=0, Warning requested=0
    Element type: SAS expander, subenclosure id: 0 [ti=7]
      Overall descriptor:
        Predicted failure=0, Disabled=0, Swap=0, status: Unsupported
        Ident=0, Fail=0
      Element 0 descriptor:
        Predicted failure=0, Disabled=0, Swap=0, status: OK
        Ident=0, Fail=0
```

4. Get the status of SES page7

[root@localhost ~]# sg_ses -p 7 /dev/sg1

```
  Wiwynn   Knox2U                  135
  Primary enclosure logical identifier (hex): 5f80f4185702a0ff
Element Descriptor In diagnostic page:
  generation code: 0x0
  element descriptor by type list
    Element type: Array device slot, subenclosure id: 0 [ti=0]
      Overall descriptor: ArrayDevicesInSubEnclsr0
      Element 0 descriptor: ArrayDevice00
      Element 1 descriptor: ArrayDevice01
        ......
    Element type: SAS connector, subenclosure id: 0 [ti=1]
      Overall descriptor: ConnectorsInSubEnclsr0
      Element 0 descriptor: Connector00
      Element 1 descriptor: Connector01
```

```
    ......
Element type: Cooling, subenclosure id: 0 [ti=2]
  Overall descriptor: CoolingElementInSubEnclsr0
  Element 0 descriptor: Fan 1 Front
  Element 1 descriptor: Fan 1 Rear
    ......
Element type: Temperature sensor, subenclosure id: 0 [ti=3]
  Overall descriptor: TempSensorsInSubEnclsr0
  Element 0 descriptor: DPB Temp. Sensor 1
  Element 1 descriptor: DPB Temp. Sensor 2
    ......
Element type: Voltage sensor, subenclosure id: 0 [ti=4]
  Overall descriptor: VoltageSensorsInSubEnclsr0
  Element 0 descriptor: SEB Voltage 1.2V
  Element 1 descriptor: SEB Voltage 3.3V
    ......
Element type: Current sensor, subenclosure id: 0 [ti=5]
  Overall descriptor: CurrentSensorsInSubEnclsr0
  Element 0 descriptor: Current Sensor 1
Element type: Enclosure, subenclosure id: 0 [ti=6]
  Overall descriptor: EnclosureElementInSubEnclsr0
  Element 0 descriptor: Knox Enclosure
Element type: SAS expander, subenclosure id: 0 [ti=7]
  Overall descriptor: SAS Expander
  Element 0 descriptor: Top ExpanderB
```

5. Get the status of SES page10

[root@localhost ~]# sg_ses -p 10 /dev/sg1

```
    Wiwynn   Knox2U                  135
  Primary enclosure logical identifier (hex): 5f80f4185702a0ff
Additional element status diagnostic page:
  generation code: 0x0
  additional element status descriptor list
    Element type: Array device slot, subenclosure id: 0 [ti=0]
      Element index: 0
        Transport protocol: SAS
        number of phys: 1, not all phys: 0, device slot number: 0
        phy index: 0
          device type: end device
          initiator port for:
          target port for: SSP
          attached SAS address: 0x5f80f4185702a0ff
          SAS address: 0x5000cca024370892
          phy identifier: 0x1
      Element index: 1
        Transport protocol: SAS
        number of phys: 1, not all phys: 0, device slot number: 1
        phy index: 0
          device type: end device
          initiator port for:
          target port for: SSP
          attached SAS address: 0x5f80f4185702a0ff
          SAS address: 0x5000cca02437102a
          phy identifier: 0x1
      ......
      ......
    Element type: SAS expander, subenclosure id: 0 [ti=7]
      Element index: 0
        Transport protocol: SAS
        number of phys: 28
        SAS address: 0x5f80f4185702a0ff
          [0] connector element index: 0, other element index: 14
          [1] connector element index: 1, other element index: 4
```

[2] connector element index: 2, other element index: 9
[3] connector element index: 3, other element index: 3
[4] connector element index: 4, other element index: 2
[5] connector element index: 5, other element index: 8
[6] connector element index: 6, other element index: 7
[7] connector element index: 7, other element index: 1
[8] connector element index: 8, other element index: 0
[9] connector element index: 9, other element index: 13
[10] connector element index: 10, other element index: 6
[11] connector element index: 11, other element index: 5
[12] connector element index: 12, other element index: 10
[13] connector element index: 13, other element index: 11
[14] connector element index: 14, other element index: 12
.....
.....

5. Checkpoints and Errors

5.1 Error Code Definition

The following listed is the full definition of Knox Error Code and it will be displayed on the Debug Card.

To get all error code via sg_read_buffer command with buffer id 0x76 as follows.

Example 1. Current status is “No error” means byte 0 (error code 0) will be set as 1.

 # sg_read_buffer --mode=1 --id=0x76 -l 100 /dev/sgX

```
00    01 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00
10    00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00
20    00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00
30    00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00
40    00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00
50    00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00
60    00 00 00 00
```

Example 2. Current status has error code 50 & 94 means byte 50 & 94 (error code 50 & 94) will be set as 1.

 # sg_read_buffer --mode=1 --id=0x76 -l 100 /dev/sgX

```
00    00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00
10    00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00
20    00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00
30    00 00 01 00 00 00 00 00  00 00 00 00 00 00 00 00
40    00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00
50    00 00 00 00 00 00 00 00  00 00 00 00 00 00 01 00
60    00 00 00 00
```

where ***/dev/sgX*** should be an SES device (such as sg1, sg2, ...)

Error Code	Description	Condition	Event Log
00	No error		
01	Expander A fault	Expander A heartbeat stop	Critical-Expander ID 0 HB Stop
02	Expander B fault	Expander B heartbeat stop	Critical-Expander ID 1 HB Stop
03	I2C bus A crash	Cannot query I2C device in I2C bus A	Critical-I2C Bus ID 0 Crash
04	I2C bus B crash	Cannot query I2C device in I2C bus B	Critical-I2C Bus ID 1 Crash
05	I2C bus C crash	Cannot query I2C device in I2C bus C	Critical-I2C Bus ID 2 Crash
06	I2C bus D crash	Cannot query I2C device in I2C bus D	Critical-I2C Bus ID 3 Crash
07	Reserved		
08	Reserved		
09	Reserved		
10	Reserved		
11	Fan 1 front fault	Cannot query fan speed in fan module 1 front*	Critical-Cooling ID 0 Fail, X(RPM)
12	Fan 1 rear fault	Cannot query fan speed in fan module 1 rear*	Critical-Cooling ID 1 Fail, X(RPM)
13	Fan 2 front fault	Cannot query fan speed in fan module 2 front*	Critical-Cooling ID 2 Fail, X(RPM)
14	Fan 2 rear fault	Cannot query fan speed in fan module 2 rear*	Critical-Cooling ID 3 Fail, X(RPM)
15	Fan 3 front fault	Cannot query fan speed in fan module 3 front*	Critical-Cooling ID 4 Fail, X(RPM)

Error Code	Description	Condition	Event Log
16	Fan 3 rear fault	Cannot query fan speed in fan module 3 rear*	Critical-Cooling ID 5 Fail, X(RPM)
17	Fan 4 front fault	Cannot query fan speed in fan module 4 front*	Critical-Cooling ID 6 Fail, X(RPM)
18	Fan 4 rear fault	Cannot query fan speed in fan module 4 rear*	Critical-Cooling ID 7 Fail, X(RPM)
19	Fan 5 front fault	Cannot query fan speed in fan module 5 front*	Critical-Cooling ID 8 Fail, X(RPM)
20	Fan 5 rear fault	Cannot query fan speed in fan module 5 rear*	Critical-Cooling ID 9 Fail, X(RPM)
21	Fan 6 front fault	Cannot query fan speed in fan module 6 front*	Critical-Cooling ID 10 Fail, X(RPM)
22	Fan 6 rear fault	Cannot query fan speed in fan module 6 rear*	Critical-Cooling ID 11 Fail, X(RPM)
23	Reserved		
24	Reserved		
25	Reserved		
26	Reserved		
27	Reserved		
28	Reserved		
29	Reserved		
30	Reserved		
31	DPB temp. sensor 1 warning	Temperature over critical threshold	Critical-Temp. ID 0 Fail, Temp=X(C)

Error Code	Description	Condition	Event Log
32	DPB temp. sensor 2 warning	Temperature over critical threshold	Critical-Temp. ID 1 Fail, Temp=X(C)
33	DPB temp. sensor 3 warning	Temperature over critical threshold	Critical-Temp. ID 2 Fail, Temp=X(C)
34	DPB temp. sensor 4 warning	Temperature over critical threshold	Critical-Temp. ID 3 Fail, Temp=X(C)
35	SEB temp. sensor A warning	Temperature over critical threshold	Critical-Temp. ID 4 Fail, Temp=X(C)
36	SEB temp. sensor B warning	Temperature over critical threshold	Critical-Temp. ID 5 Fail, Temp=X(C)
37	Ambient temp. sensor A1 warning	Temperature over critical threshold	Critical-Temp. ID 6 Fail, Temp=X(C)
38	Ambient temp. sensor A2 warning	Temperature over critical threshold	Critical-Temp. ID 7 Fail, Temp=X(C)
39	Ambient temp. sensor B1 warning	Temperature over critical threshold	Critical-Temp. ID 8 Fail, Temp=X(C)
40	Ambient temp. sensor B2 warning	Temperature over critical threshold	Critical-Temp. ID 9 Fail, Temp=X(C)
41	BJT temp. sensor 1 warning	Temperature over critical threshold*	Critical-Temp. ID 10 Fail, Temp=X(C)
42	BJT temp. sensor 2 warning	Temperature over critical threshold*	Critical-Temp. ID 11 Fail, Temp=X(C)
43	Reserved		
44	Reserved		
45	SEB voltage sensor warning	Voltage over or under critical threshold	Critical-Voltage ID? Fail, V=X(mV) (ID: Voltage sensor on SEB)

Error Code	Description	Condition	Event Log
46	DPB voltage sensor warning	Voltage over or under critical threshold	Critical-Voltage ID? Fail, V=X(mV) (ID: Voltage sensor on DPB)
47	FCB voltage sensor warning	Voltage over or under critical threshold*	Critical-Voltage ID? Fail, V=X(mV) (ID: Voltage sensor on FCB)
48	FCB current sensor warning	Current over or under critical threshold*	Critical-Current ID 0 Fail, I=X(mA)
49	Reserved		
50	HDD0 SMART temp. warning	HDD0 Temperature over critical threshold	Critical-Temp. ID 12 Fail, Temp=X(C)
51	HDD1 SMART temp. warning	HDD1 Temperature over critical threshold	Critical-Temp. ID 13 Fail, Temp=X(C)
52	HDD2 SMART temp. warning	HDD2 Temperature over critical threshold	Critical-Temp. ID 14 Fail, Temp=X(C)
53	HDD3 SMART temp. warning	HDD3 Temperature over critical threshold	Critical-Temp. ID 15 Fail, Temp=X(C)
54	HDD4 SMART temp. warning	HDD4 Temperature over critical threshold	Critical-Temp. ID 16 Fail, Temp=X(C)
55	HDD5 SMART temp. warning	HDD5 Temperature over critical threshold	Critical-Temp. ID 17 Fail, Temp=X(C)
56	HDD6 SMART temp. warning	HDD6 Temperature over critical threshold	Critical-Temp. ID 18 Fail, Temp=X(C)
57	HDD7 SMART temp. warning	HDD7 Temperature over critical threshold	Critical-Temp. ID 19 Fail, Temp=X(C)
58	HDD8 SMART temp. warning	HDD8 Temperature over critical threshold	Critical-Temp. ID 20 Fail, Temp=X(C)
59	HDD9 SMART temp. warning	HDD9 Temperature over critical threshold	Critical-Temp. ID 21 Fail, Temp=X(C)

Error Code	Description	Condition	Event Log
60	HDD10 SMART temp. warning	HDD10 Temperature over critical threshold	Critical-Temp. ID 22 Fail, Temp=X(C)
61	HDD11 SMART temp. warning	HDD11 Temperature over critical threshold	Critical-Temp. ID 23 Fail, Temp=X(C)
62	HDD12 SMART temp. warning	HDD12 Temperature over critical threshold	Critical-Temp. ID 24 Fail, Temp=X(C)
63	HDD13 SMART temp. warning	HDD13 Temperature over critical threshold	Critical-Temp. ID 25 Fail, Temp=X(C)
64	HDD14 SMART temp. warning	HDD14 Temperature over critical threshold	Critical-Temp. ID 26 Fail, Temp=X(C)
65	Expander A Internal temp. warning	Expander A Internal Temperature over critical threshold	Critical-Temp. ID 27 Fail, Temp=X(C)
66	Expander B Internal temp. warning	Expander B Internal Temperature over critical threshold	Critical-Temp. ID 28 Fail, Temp=X(C)
67	Reserved		
68	Reserved		
69	Reserved		
70	HDD0 fault	HDD0 Array Device Element status fault	Critical-HDD Slot 0 Status Fault
71	HDD1 fault	HDD1 Array Device Element status fault	Critical-HDD Slot 1 Status Fault
72	HDD2 fault	HDD2 Array Device Element status fault	Critical-HDD Slot 2 Status Fault
73	HDD3 fault	HDD3 Array Device Element status fault	Critical-HDD Slot 3 Status Fault
74	HDD4 fault	HDD4 Array Device Element status fault	Critical-HDD Slot 4 Status Fault

Error Code	Description	Condition	Event Log
75	HDD5 fault	HDD5 Array Device Element status fault	Critical-HDD Slot 5 Status Fault
76	HDD6 fault	HDD6 Array Device Element status fault	Critical-HDD Slot 6 Status Fault
77	HDD7 fault	HDD7 Array Device Element status fault	Critical-HDD Slot 7 Status Fault
78	HDD8 fault	HDD8 Array Device Element status fault	Critical-HDD Slot 8 Status Fault
79	HDD9 fault	HDD9 Array Device Element status fault	Critical-HDD Slot 9 Status Fault
80	HDD10 fault	HDD10 Array Device Element status fault	Critical-HDD Slot 10 Status Fault
81	HDD11 fault	HDD11 Array Device Element status fault	Critical-HDD Slot 11 Status Fault
82	HDD12 fault	HDD12 Array Device Element status fault	Critical-HDD Slot 12 Status Fault
83	HDD13 fault	HDD13 Array Device Element status fault	Critical-HDD Slot 13 Status Fault
84	HDD14 fault	HDD14 Array Device Element status fault	Critical-HDD Slot 14 Status Fault
85	Reserved		
86	Reserved		
87	Reserved		
88	Reserved		
89	Reserved		
90	External Mini-SAS link error	Loss of SAS links (x1~x3)	Critical-Connector ID 16 Loss Link(s)
91	Internal Mini-SAS 1 link error	Loss of SAS links (x1~x3)	Critical-Connector ID 20 Loss Link(s)

Error Code	Description	Condition	Event Log
92	Internal Mini-SAS 2 link error	Loss of SAS links (x1~x3)	Critical-Connector ID 24 Loss Link(s)
93	Self tray be pulled out	F/W detect self tray be pulled out*	Critical-Self Tray Be Pulled Out
94	Peer tray be pulled out	F/W detect peer tray be pulled out*	Critical-Peer Tray Be Pulled Out
95	Reserved		
96	Reserved		
97	Reserved		
98	Reserved		
99	Firmware and hardware not match	Only show this error code when FW initialization and then FW will hang*	N/A
N/A	Self tray be pushed in	F/W detect self tray be pushed in	Infomation-Self Tray Be Pushed In
N/A	Peer tray be pushed in	F/W detect peer tray be pushed in	Information-Peer Tray Be Pushed In

Notes:

- (*) Error code may be caused by cable issues (physical damage, incorrect installation or disconnected cables)
- When flashing SEB firmware and reset for it to take effect, the RAID volume will become unconfigured, bad and foreign. Due to eeprom update process during reset, the connection between SEB and RAID card will be temporarily off, thus causing the RAID volume to be in offline state. It'll require a manual configuration and import for it to restore to its original state.

- When manually adjusting HDD LED while HDD is present in the slot (i.e. forcibly changing blue to red, or blue to off), due to the nature of LSI RAID card, it'll change the LED back to its original state as it reckons the drive is still present.
- An errata for SEB F/W has a chance to report invalid (fake) Fan speed and FCB voltage during error handling for sensor reading. If this happens, the F/W will just record an event in the event log. After that, the sensor reading will become normal. This event does not affect the system and can be ignored. This issue might occur on SEB F/W version 21.14.00.04 or earlier versions.
- Error 99: an error code of 99 will be displayed on debug card along with full rotation rpm on all the fans when SAS Expander Board (SEB) are mixed among Knox & Cold Storage.
- HDD SMART temperature error code of 50 to 64 will not be visually displayed on debug card nor through wknoxutil -- showdebugid when storage system is populated with SATA drives.
- SAS HDD temperature polling is disabled by default from Expander FW version 21.14.00.04.

- HDD location